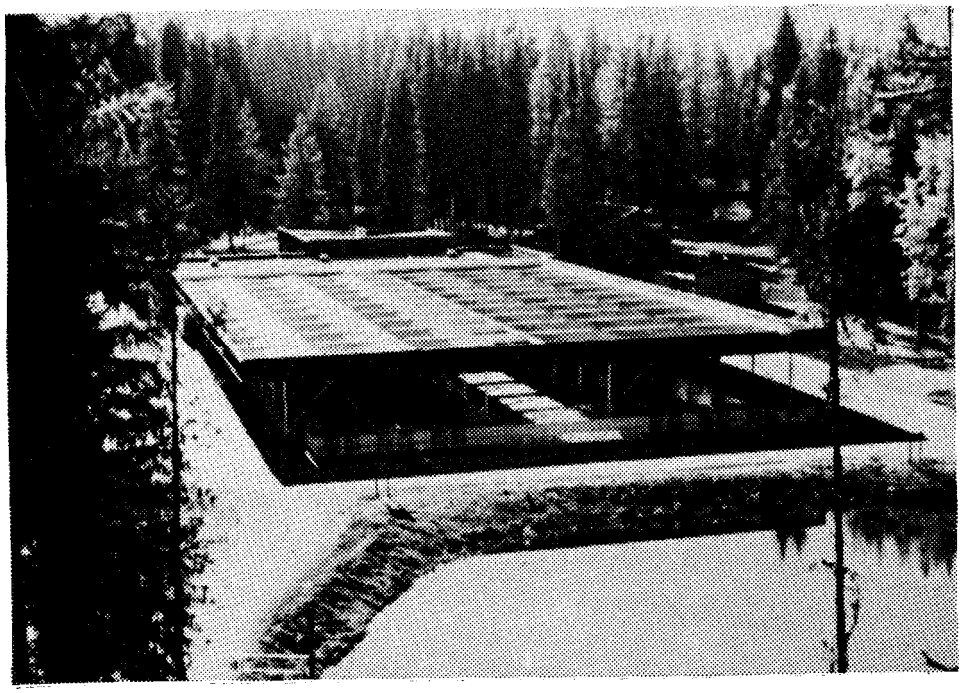
LOWER SNAKE RIVER COMPENSATION PLAN
*Hatchery Program*

# MCCALL FISH HATCHERY

## 1991 Summer Chinook Salmon Brood Year Report



**by**

**Donald E. McPherson**
**Fish Hatchery Superintendent III**

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**ABSTRACT**

The South Fork Salmon River weir and trap were put into operation on June 21, 1991, with the conclusion of trapping on September 10, 1991.

Salmon spawning at the trap commenced on August 13 and concluded on September 10, 1991. A total of 1,212 returning chinook salmon were trapped, measured, and recorded during this period. The overall average eye-up from eggs taken was 90.4%, with a total overall survival of 86.3% to smolt release.

Of the 1,212 salmon trapped, 235 were females, 162 were ponded, and 73 were released with a pre-spawn mortality of 24 fish, or 14.8%. There were 156 adult males trapped, 112 were ponded, and 44 were released upstream with a pre-spawn mortality of 2 fish, or 1.8%. There were 821 jacks trapped (according to length frequency criteria); 650 were ponded, 157 were killed at spawning as they were ad-clipped, and only 9 were used for spawning. There were 404 jacks given away, 171 were released upstream, and 89 died in the holding pond for a 13.7% mortality.

From the 162 ponded females, 138 were spawned yielding 704,016 green eggs, for an average fecundity of 5,102 eggs per female.

During the month of April through the first week of May 1993, there were 607,298 brood year 1991 smolts, weighing 33,659 pounds, transported and released at Knox bridge on the South Fork of the Salmon River near Warm Lake.

Author:

Donald E. McPherson
Fish Hatchery Superintendent III

## INTRODUCTION

McCall Fish Hatchery was built in 1979 as a result of the Water Resources Development Act enacted by congress in 1976. A portion of this act is the Lower Snake River Compensation Plan (LSRCP). The LSRCP compensates Idaho for fish and wildlife losses caused by the Lower Snake River Projects (Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams). The McCall Fish Hatchery was the first hatchery built as a partial fulfillment of the LSRCP. This funding is administered to the Idaho Department of Fish and Game (IDFG) by the U.S. Fish and Wildlife Service (USFWS).

The McCall Fish Hatchery is located within the city limits of McCall, Idaho along the North Fork of the Payette River, approximately 0.16 km (1/4 mile) downstream from Payette Lake.

A satellite facility for trapping and spawning adult chinook salmon is located on the South Fork of the Salmon River near Warm Lake, approximately 26 miles east of Cascade, Idaho.

The main production for McCall Hatchery is summer chinook salmon reared to smolt size. There is also a resident trout program funded solely by IDFG.

The first salmon reared at the McCall Hatchery were transferred in from the Mackay Fish Hatchery and Dworshak/Kooskia National Fish Hatchery Complex. These eggs were the product of adult summer chinook trapped at Little Goose and Lower Granite dams. The first eggs from the South Fork of the Salmon trap were taken in August of 1980.

## OBJECTIVES

The mitigation goal is to return 8,000 adult summer chinook salmon above Lower Granite Dam. The objectives of the McCall Hatchery are:

1. Restore summer chinook salmon Oncorhynchus tshawytscha to the South Fork of the Salmon River; historically a major summer chinook stream in Idaho.
2. Trap and spawn adult salmon returning to the South Fork of Salmon River.
3. Raise 1,000,000 summer chinook smolts for release into the South Fork of the Salmon River.
4. Evaluate fish rearing capabilities of McCall Hatchery.
5. Work with management and research personnel to identify optimum operating procedures for the McCall Hatchery.

## FISH REARING FACILITIES

The hatchery facility consists of six buildings on approximately 15 acres of ground. The largest building consists of a shop, parking garage, incubation and early rearing area, generator room, and feed/freezer room. The office and three-bedroom dormitory are contained in one building. There is a visitors center with restrooms, a flow chart for a self-guided tour, and historical information signs. There are three residences for permanent personnel also located on the site.

The fish production units include:

1. Twenty-six 8-tray stacks of F.A.L. (Heath type) incubators.

2. Fourteen concrete vats 4 ft x 40 ft x 2 ft (water depth); 320 cubic feet of rearing area per vat.

3. Two concrete rearing ponds 196 ft x 40.5 ft x 3 ft (water depth); 23,814 cubic feet of rearing space per pond.

4. One concrete collection basin 101 ft x 15 ft x 4 ft (water depth).

Designed capacity of the hatchery is to raise 1,000,000 smolts averaging 17 fish/pound.

An adult trapping and spawning facility is located on the South Fork of the Salmon River near Warm Lake. This facility is equipped with a removable weir, fish ladder, trap, two adult holding ponds (10 ft x 90 ft), and a covered spawning area. Water is supplied from the South Fork of the Salmon River through a 33-inch underground pipeline. Holding capacity for the facility is approximately 1,000 adults. Adults trapped in the excess of the egg needs are passed above the weir for natural spawning. Eggs collected at the facility are transported "green" to McCall for incubation and rearing.

## WATER SUPPLY

Hatchery water is obtained by gravity flow from Payette Lake through a 36-inch underground pipeline. Water may be taken from the surface or a depth of 50 feet, thus providing the capability of obtaining the best water temperature available.

Through an agreement with the Payette Lake Reservoir Company, 20 cubic feet per second (cfs) of water is available for hatchery use. Design criteria and production goals were established using this constraint, ensuring that the hatchery has enough water to meet its production goals.

Water quality analysis reveals a somewhat "distilled" system for rearing fish (Appendix H). Total hardness ranges from 6.3 to 7.06 mg CaCO3\1, while pH stays about 6.8. There are no problems with heavy metals, and the temperature is maintained at 52°F to 56°F, with a low of 37°F during the winter months.

## STAFFING

The hatchery is staffed with three permanent employees: a Hatchery Superintendent III, a Hatchery Superintendent I, and a Fish Culturist. In addition, there are four temporary employees to assist during the busy field season.

## TRAPPING AND SPAWNING

The weir and trap on the South Fork of the Salmon River were put into operation on June 21, 1991, and trapping continued through September 10, 1991. The peak of the run was July 15.

There were 1,212 fish trapped; 235 (19%) were females and 977 (81%) were males. Eighty-four percent of the males, or 821 fish, were jacks according to length frequency criteria. There were 73 females and 215 males (including 171 jacks) released upstream. Fork lengths were taken on all fish trapped (Appendix A). All of the released fish were tagged with Peterson Discs and jaw tags. The tagging and follow-up was conducted by the University of Idaho personnel to determine the hatchery and wild fish interaction and differences in spawning area. From the 1,212 fish trapped, 268 were ad-clipped indicating coded wire tags (CWT). All of these fish had their snouts removed and sent to the Lewiston lab for tag recovery and identification.

The age class determination by length frequency was used at the trap site during initial trapping. The CWT recovery data and scale analysis showed an overlap of age classes originally determined by length frequency (Table 1).

Table 1. Age distribution of 1991 summer chinook salmon returns to McCall Fish Hatchery (SFSR) based on CWT data and length frequency data.

| | Males | | Females | |
|---|---|---|---|---|
| Aqe | CWT estimate | Length/freq estimate | CWT estimate | Length/freq estimate |
| 3 | 783 | 821 | 4 | 0 |
| 4 | 164 | 134 | **196** | 214 |
| 5 | 30 | 22 | 35 | 21 |
| TOTALS | 977 | 977 | 235 | **235** |

CWT data based on 240 tags recovered from 268 snouts and expanded for entire run.
Length data taken at trapping prior to first sort.

Age class breakdown:
66 cm = jacks
67 cm - 89 cm = 4-year-olds
>90 cm = 5-year-olds

All of the fish except jacks were injected at trapping with Erythromycin Phosphate in the dorsal sinus area at **a** rate of 1 cc per 10 pounds of body weight from a stock solution of 15.4 grams Erythromycin Phosphate per 250 mls distilled water. The adult males and females were put in the same holding pond and the jacks were placed in the other. The adults were treated with 167 ppm formalin three days per week for fungus control. The jacks were destined to be distributed to the Shoshone-Bannock tribes and were untreated and uninjected.

Pre-spawn mortality in the adults was 24 females (14.8%) and 2 males (1.8%). The jack pre-spawn mortality was 89 fish (13.7%).

Spawntaking activities started August 13 and concluded September 10, 1991. There were eight spawn days during this period, with 704,016 eggs taken from 138 females for an average fecundity of 5,102 eggs/female. There were 89 adult males and 9 jacks used for fertilization. All eggs taken were water-hardened for one hour in a 100 ppm titrateable iodine solution prior to being transported back to McCall Hatchery.

The fecundity rate was estimated at 4,500 eggs/female until the eye-up stage is reached and the eggs are enumerated. At eye-up, the eggs are shocked by siphon, picked with an electronic picker, and enumerated by displacement.

Incubator flows are set a 5 gallons/minute and are loaded at 2,000 cc, or approximately 8,000 eggs per tray. If space allows, 1,500 to 1,800 cc of eggs per tray is utilized. The eggs are treated with 1,667 ppm of formalin for 15 minutes starting 3 days after fertilization, and continues on a daily basis until the eggs start to hatch.

Eggs eye-up at approximately 600 thermal units (TU) and are then shocked, picked, and enumerated. Hatching starts at approximately 925 TUs. There were 636,291 eggs that survived to the eyed stage from the original 704,016 for an average eye-up of 90.4%

## FISH PRODUCTION

### Early Rearing

Fry are set out to the concrete vats approximately three days prior to initial feeding. Initial feeding begins between 1,750 and 1,775 TUs. Flows for the vats are set at 80 gallons/minute and are loaded at 70,000 to 100,000 fish/vat, depending on the number of fry on hand. The vats start at half length and are extended to full length when the density index (DI) reaches .40, usually around mid-February.

Beginning growth rates are slow, only .003 to .004 inches/day, due to cold water temperatures of only 37°F to 39°F. The fry are started on Bio-Diet #2 and #3 feed, and stay on #3 until they reach 700 fish/pound. Bio-Diet feed has been used successfully at McCall Hatchery using modified feed rates. The conversion rates average 1.1 to 1.3 during the fry rearing stage.

Fish are moved outside to the final rearing ponds mid-May at about 250 to 350 fish/pound. The two ponds were loaded at 320,000 fish/pond, about a third lighter than the normal loading of 500,000 fish/pond, to achieve a 1,000,000 smolt release averaging 17 fish/pound. Pond #1 fish received adipose fin clips and Coded Wire Tags (CWT) and were also fed a TM-100 feed treatment for 14 days to give them a florescent mark on the vertebra for a retention test. Pond #2 received CWT, adipose and right ventral fin clips, and Passive Integrated Transponder (PIT) tags. (Appendix J).

The fish are fed two medicated feed treatments of Gallimycin at 4.5 grams of active Erythromycin Phosphate/100 pounds of fish at 2% body weight during the rearing cycle. The first feeding was just prior to ponding, and the second was late August.

There were no major disease problems noted for brood year 1991 fish and no significant mortality noted. The temperature ranges from 45°F in May, to 55°F in August, and down to 37°F in February. This variation in temperature contributes to variable growth rates and daily length increase rates of .003 to .023. Feed rates average 1.5% of body weight.

## FISH HEALTH

### Diseases Encountered and Treated

No significant acute or chronic losses were experienced at McCall Hatchery within the 1991 South Fork summer chinook fish. Etiological agents that were found in these fish were limited to Bacterial Kidney Disease (BKD) in brood and juvenile fish. Slightly higher than normal mortality was experienced on adults at the South Fork of the Salmon trap following severe thunderstorm activity and heavy silt loads in the river.

### Acute Losses

Acute losses were not experienced in the fish at McCall Hatchery. Chronic losses were limited to the yearly episode of "Spring Thing" and were light; there was a loss of 1.7% during the months of April and May, or 20,503 fish. A treatment for this condition was not applied.

### Other Assessments

Preliberation and Organosomatic sampling revealed a slightly larger fish than normal, with most parameters in normal ranges for this stock of fish. BKD was detected via ELISA (Enzyme Linked Immunosorbent Assay) in 3/6 of the pools of sampled fish (10 fish/pool). All positive groups were considered low positives. Utilizing FAT (Fluorescent Antibody Test), there were no positives detected in the same fish.

Organosomatic data showed that the mesenteric fat averaged between 3 and 4. This goal was established by McCall Hatchery staff earlier in the growing season. The stored energy in the adipose deposits may help the smolt make the transition from a hatchery habitat to the wild. Further data collection is warranted regarding optimum mesenteric fat levels for hatchery smolts.

## FISH MARKING

The fish marking crews began work on September 28 and finished October 6, 1992. There was a total of 608,178 fish marked. There were 475,428 that received CWT and adipose fin clips, 132,250 that received a right ventral fin clip (RV), and 500 received PIT tags and RV clip. The marking crew came back in March 1993 and PIT-tagged an additional 4,500 fish. Of these 3,000 were for fish passage and 1,500 for a time-of-release experiment. There were to be four groups of 500 PIT-tagged fish released at different intervals. The first group of 500 is included in the 3,000 for fish passage and was released with the general production release. The other three groups of 500 PIT-tagged fish were released on April 9, April 24, and May 5, 1993. A portion of these fish were hand-tagged and a portion machine-tagged to compare mortality, tag loss, etc. There were 310,448 fish in pond 11 that were marked with a TM-100 oral feed treatment (Appendix J).

## FISH DISTRIBUTION

The brood year 1991 smolt hauling operation was set to begin on March 24, 1993 for the general production fish plus 500 PIT-tagged time-of-release fish. This release was delayed until April 3, 1993 due to the permit process through the National Marine Fisheries Service. There were 308,300 fish released April 3 and 4. The supplementation release of 297,500 went as scheduled, on April 21 and 22, 1993. There were three small releases of fish for the time-of-release study; 500 fish on April 9, 499 fish on April 22, and 499 fish on May 5, 1993. The total release for brood year 1991 was 607,298 fish weighing 33,659 pounds.

## STUDIES

There were two research projects started on brood year 1991 smolts. The first was the supplementation project. There were 132,750 fish marked with a right ventral fin clip; 500 of these were also PIT-tagged. These fish were to be released later than normal production fish to closer correspond with the natural production migration.

The other small-scale project was the release of 2,000 PIT-tagged fish at four different dates, in groups of 500 fish, to try to determine the optimum time of release, travel time, and survival rate to Lower Granite Dam. There were 500 of these fish released with the general production group on April 3 and 4. The other three groups were kept in live boxes to keep accurate mortality records. The first group of the three was a 500 fish release on April 9; the next was a 499 fish release on April 22; and the last group was a 499 fish release on May 5, 1993. The first release group had a survival rate of 38.7% with a travel time of 39.9 days; release group two had a survival rate of 43.6% with a travel time of 29.6 days; and the third group had a survival rate of 43.4% and a travel time of 23.8 days. Survival rates were comparable, and arrival time was about the same.

## CONCLUSIONS

The brood year 1991 fish appeared to be in good condition throughout the rearing cycle. There appeared to be good survival to Lower Granite Dam; the overall survival rate was 41.9% for all groups released. The fish were larger in size, reared in lower densities, and were release later than previous years (April 3 for the main production group and April 21 for the supplementation group) as opposed to the third week of March. There were only 607,298 fish reared in the outside ponds compared to the 1,000,000 smolt capacity. The release pipe and tempering pump were utilized again this year. Releases were smooth. The river flows were higher than previous years, and the main run-off came later.

# A P P E N D I C E S

Appendix A1. Lengths of brood year 1991 trapped fish.

| Fork length (cm) | Males | Females |
|---|---|---|
| 39 | 3 | 0 |
| 40 | 2 | 0 |
| 41 | 1 | 0 |
| 42 | 5 | 0 |
| 43 | 1 | 0 |
| 44 | 8 | 0 |
| 45 | 11 | 0 |
| 46 | 10 | 0 |
| 47 | 19 | 0 |
| 48 | 20 | 0 |
| 49 | 49 | 0 |
| 50 | 38 | 0 |
| 51 | 62 | 0 |
| 52 | 51 | 0 |
| 53 | 75 | 0 |
| 54 | 57 | 0 |
| 55 | 70 | 0 |
| 56 | 58 | 0 |
| 57 | 68 | 0 |
| 58 | 53 | 0 |
| 59 | 38 | 0 |
| 60 | 32 | 0 |
| 61 | 28 | 0 |
| 62 | 19 | 0 |
| 63 | 19 | 0 |
| 64 | 14 | 0 |
| 65 | 7 | 0 |
| 66 | 3 | 0 |
| 67 | 4 | 0 |
| 68 | 5 | 3 |
| 69 | 7 | 1 |
| 70 | 6 | 4 |
| 71 | 10 | 0 |
| 72 | 4 | 1 |
| 73 | 12 | 1 |
| 74 | 12 | 2 |
| 75 | 1 | 3 |
| 76 | 5 | 4 |
| 77 | 7 | 0 |
| 78 | 1 | 1 |
| 79 | 3 | 2 |
| 80 | 3 | 2 |

Appendix Al. Continued.

| Fork length (cm) | Males | Females |
|---|---|---|
| 81 | 4 | 2 |
| 82 | 1 | 5 |
| 83 | 1 | 3 |
| 84 | 2 | 15 |
| 85 | 2 | 13 |
| 86 | 3 | 11 |
| 87 | 7 | 15 |
| 88 | 6 | 28 |
| 89 | 2 | 13 |
| 90 | 4 | 29 |
| 91 | 8 | 17 |
| 92 | 5 | 15 |
| 93 | 6 | 15 |
| 94 | 3 | 9 |
| 95 | 4 | 10 |
| 96 | 2 | 5 |
| 97 | 1 | 3 |
| 98 | 6 | 1 |
| 99 | 2 | 1 |
| 100 | 3 | 1 |
| 101 | 1 | 0 |
| 102 | 1 | 0 |
| 103 | 2 | 0 |
| 104 | 0 | 0 |
| 105 | 0 | 0 |
| Total Measured | 977 | 235 |

Appendix A2. Lengths of brood year 1991 South Fork Salmon River fish released.

| Fork length (cm) | Males | Females |
|---|---|---|
| 45 | 3 | 0 |
| 46 | 0 | 0 |
| 47 | 1 | 0 |
| 48 | 1 | 0 |
| 49 | 7 | 0 |
| 50 | 6 | 0 |
| 51 | 16 | 0 |
| 52 | 15 | 0 |
| 53 | 19 | 0 |
| 54 | 15 | 0 |
| 55 | 18 | 0 |
| 56 | 17 | 0 |
| 57 | 9 | 0 |
| 58 | 10 | 0 |
| 59 | 11 | 0 |
| 60 | 7 | 0 |
| 61 | 4 | 0 |
| 62 | 1 | 0 |
| 63 | 5 | 0 |
| 64 | 3 | 0 |
| 65 | 2 | 0 |
| 66 | 1 | 0 |
| 67 | 0 | 0 |
| 68 | 0 | 1 |
| 69 | 1 | 0 |
| 70 | 2 | 2 |
| 71 | 3 | 0 |
| 72 | 1 | 0 |
| 73 | 4 | 1 |
| 74 | 3 | 2 |
| 75 | 1 | 0 |
| 76 | 0 | 2 |
| 77 | 3 | 0 |
| 78 | 1 | 0 |
| 79 | 1 | 1 |
| 80 | 1 | 1 |
| 81 | 1 | 1 |
| 82 | 0 | 0 |
| 83 | 0 | 1 |
| 84 | 0 | 3 |
| 85 | 0 | 2 |

Appendix A2. Continued.

| Fork length (cm) | Males | Females |
|---|---|---|
| 86 | 0 | 5 |
| 87 | 4 | 6 |
| 88 | 1 | 11 |
| 89 | 2 | 5 |
| 90 | 2 | 5 |
| 91 | 3 | 6 |
| 92 | 2 | 4 |
| 93 | 1 | 5 |
| 94 | 1 | 2 |
| 95 | 0 | 3 |
| 96 | 2 | 1 |
| 97 | 0 | 2 |
| 98 | 1 | 0 |
| 99 | 1 | 1 |
| 100 | 2 | 0 |
| 101 | 0 | 0 |
| 102 | 0 | 0 |
| 103 | 0 | 0 |
| 104 | 0 | 0 |
| Total Measured | 215 | 73 |

Appendix A3. Lengths of brood year 1991 South Fork Salmon River adult salmon ponded.

| Fork length (cm) | Males | Females |
|---|---|---|
| 67 | 4 | 0 |
| 68 | 5 | 2 |
| 69 | 6 | 1 |
| 70 | 4 | 2 |
| 71 | 7 | 0 |
| 72 | 3 | 1 |
| 73 | 8 | 0 |
| 74 | 9 | 0 |
| 75 | 0 | 3 |
| 76 | 5 | 2 |
| 77 | 4 | 0 |
| 78 | 0 | 1 |
| 79 | 2 | 1 |
| 80 | 2 | 1 |
| 81 | 3 | 1 |
| 82 | 1 | 5 |
| 83 | 1 | 2 |
| 84 | 2 | 12 |
| 85 | 2 | 11 |
| 86 | 3 | 6 |
| 87 | 3 | 9 |
| 88 | 5 | 17 |
| 89 | 0 | 8 |
| 90 | 2 | 24 |
| 91 | 5 | 11 |
| 92 | 3 | 11 |
| 93 | 5 | 10 |
| 94 | 2 | 10 |
| 95 | 4 | 7 |
| 96 | 0 | 4 |
| 97 | 1 | 1 |
| 98 | 5 | 1 |
| 99 | 1 | 0 |
| 100 | 1 | 1 |
| 101 | 1 | 0 |
| 102 | 1 | 0 |
| 103 | 2 | 0 |
| 104 | 0 | 0 |
| 105 | 0 | 0 |
| Total Measured | 112 | 162 |

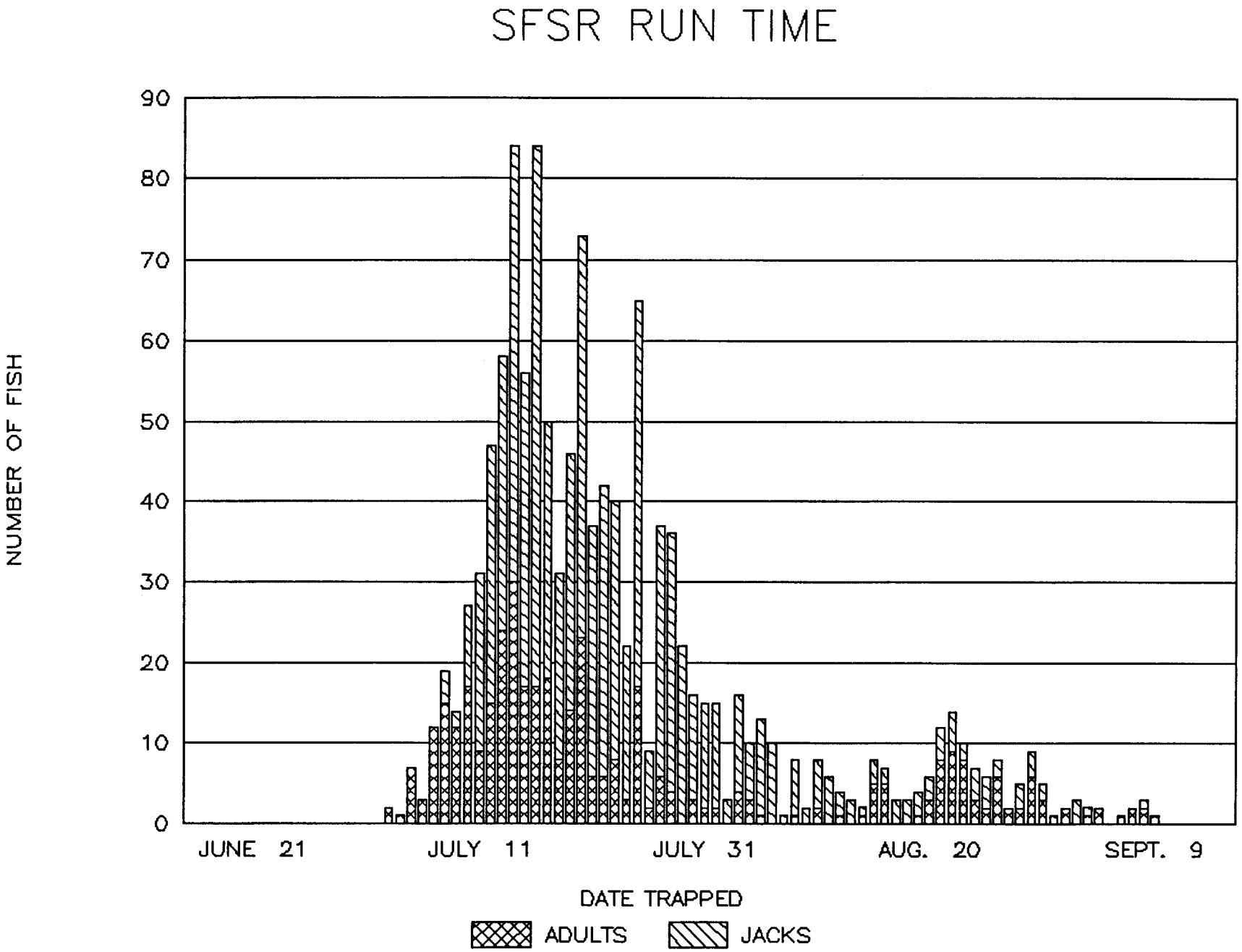
The male total does not include 650 jacks ponded. These numbers represent adult salmon ponded prior to first sort.

Appendix B. Adult returns of South **Fork** Salmon **River** brood **year 1991** and run timing.

| Date | Total run | Males | Females | Jacks |
|---|---|---|---|---|
| Jun 21 | 0 | 0 | 0 | 0 |
| **22** | 0 | 0 | 0 | 0 |
| **23** | 0 | 0 | 0 | 0 |
| **24** | 0 | 0 | 0 | 0 |
| **25** | 0 | 0 | 0 | 0 |
| **26** | 0 | 0 | 0 | 0 |
| 27 | 0 | 0 | 0 | 0 |
| 28 | 0 | 0 | 0 | 0 |
| 29 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 0 | 0 |
| Jul 1 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 |
| 3 | 2 | 0 | 2 | 0 |
| 4 | 1 | 0 | 1 | 0 |
| 5 | 7 | 4 | 3 | 0 |
| 6 | 3 | 2 | 1 | 0 |
| 7 | 12 | 4 | 8 | 0 |
| 8 | 19 | 5 | 10 | 4 |
| 9 | 14 | 3 | 9 | 2 |
| 10 | 27 | 7 | 10 | 10 |
| 11 | 31 | 2 | 7 | 22 |
| 12 | 47 | 4 | 11 | 32 |
| 13 | 58 | 3 | 21 | 34 |
| 14 | 84 | 16 | 14 | 54 |
| 15 | 56 | 3 | 14 | 39 |
| 16 | 84 | 5 | 12 | 67 |
| 17 | 50 | 3 | 15 | 32 |
| 18 | 31 | 4 | 4 | 23 |
| 19 | 46 | 6 | 8 | 32 |
| 20 | 73 | 13 | 11 | 49 |
| 21 | 37 | 1 | 5 | 31 |
| 22 | 42 | 1 | 5 | 36 |
| 23 | 40 | 2 | 6 | 32 |
| 24 | 22 | 1 | 2 | 19 |
| 25 | 65 | 6 | 11 | 48 |
| 26 | 9 | 1 | 1 | 7 |
| 27 | 37 | 3 | 3 | 31 |
| 28 | 36 | 2 | 2 | 32 |
| 29 | 22 | 0 | 0 | 22 |
| 30 | 16 | 1 | 3 | 13 |
| 31 | 15 | 1 | 1 | 13 |
| Aug 1 | 15 | 1 | 1 | 13 |
| 2 | 3 | 0 | 0 | 3 |

Appendix B. Continued.

| Date | | Total run | Males | Females | Jacks |
|---|---|---|---|---|---|
| | 3 | 16 | 2 | 2 | 12 |
| | 4 | 10 | 0 | 3 | 7 |
| | 5 | 13 | 0 | 1 | 12 |
| | 6 | 9 | 0 | 0 | 9 |
| | 7 | 1 | 0 | 0 | 1 |
| | 8 | 8 | 1 | 0 | 7 |
| | 9 | 2 | 0 | 0 | 2 |
| | 10 | 8 | 2 | 0 | 6 |
| | 11 | 6 | 0 | 0 | 6 |
| | 12 | 4 | 1 | 0 | 3 |
| | 13 | 3 | 0 | 0 | 3 |
| | 14 | 2 | 1 | 0 | 1 |
| | 15 | 8 | 2 | 3 | 3 |
| | 16 | 7 | 4 | 1 | 2 |
| | 17 | 3 | 0 | 0 | 3 |
| | 18 | 3 | 0 | 0 | 3 |
| | 19 | 4 | 1 | 0 | 3 |
| | 20 | 6 | 1 | 2 | 3 |
| | 21 | 12 | 5 | 3 | 4 |
| | 22 | 14 | 6 | 3 | 5 |
| | 23 | 10 | 3 | 5 | 2 |
| | 24 | 7 | 1 | 2 | 4 |
| | 25 | 6 | 2 | 0 | 4 |
| | 26 | 8 | 2 | 4 | 2 |
| | 27 | 2 | 1 | 1 | 0 |
| | 28 | 5 | 1 | 1 | 3 |
| | 29 | 9 | 5 | 1 | 3 |
| | 30 | 5 | 3 | 0 | 2 |
| | 31 | 1 | 0 | 0 | 1 |
| Sep | 1 | 2 | 2 | 0 | 0 |
| | 2 | 3 | 0 | 0 | 3 |
| | 3 | 2 | 1 | 0 | 1 |
| | 4 | 2 | 1 | 1 | 0 |
| | 5 | 0 | 0 | 0 | 0 |
| | 6 | 1 | 1 | 0 | 0 |
| | 7 | 2 | 2 | 0 | 0 |
| | 8 | 3 | 1 | 1 | 1 |
| | 9 | 1 | 1 | 0 | 0 |
| | 10 | 0 | 0 | 0 | 0 |
| Total | | 1,212 | 156 | 235 | 821 |




Appendix C. South Fork Salmon River run timing.

Appendix D. Historic hatchery releases and returns.

| Brood Year | Year | Number Fish | 3 yr old | Year return | 4 yr old | Year return | 5 yr old | Year return | Percent return |
|---|---|---|---|---|---|---|---|---|---|
| 1978 | 1980 | 124,800 | 124 | 1981 | 462 | 1982 | 161 | 1983 | 0.598 |
| 1979 | 1981 | 248,926 | 48 | 1982 | 272 | 1983 | 221 | 1984 | 0.217 |
| 1980 | 1982 | 122,247 | 504 | 1983 | 713 | 1984 | 151 | 1985 | 1.119 |
| 1981 | 1983 | 183,896 | 595 | 1984 | 1,259 | 1985 | 203 | 1986 | 1.119 |
| 1982 | 1984 | 269,880 | 828 | 1985 | 1,265 | 1986 | 202 | 1987 | 0.85 |
| 1983 | 1985 | 564,405 | 1,222 | 1986 | 2,117 | 1987 | 893 | 1988 | 0.674 |
| 1984 | 1986 | 970,348 | 386 | 1987 | 1,392 | 1988 | 191 | 1989 | 0.255 |
| 1985 | 1987 | 958,300 | 50 | 1988 | 252 | 1989 | 30 | 1990 | 0.035 |
| 1986 | 1988 | 1,060,400 | 495 | 1989 | 911 | 1990 | 154 | 1991 | 0.147 |
| 1987 | 1989 | 975,000 | 28 | 1990 | 237 | 1991 | 25 | 1992 | 0.029 |
| 1988 | 1990 | 1,032,500 | 821 | 1991 | 2,617 | 1992 | 0 | 1993 | |
| 1989 | 1991 | 708,600 | 206 | 1992 | 0 | 1993 | 0 | 1994 | |
| 1990 | 1992 | 901,500 | 0 | 1993 | 0 | 1994 | 0 | | |
| 1991 | 1993 | 607,298 | 0 | 1994 | | | | | |

The 3 yr old return was 205 males plus 1 female.

Appendix E. Summer chinook distribution in the South Fork of the Salmon River.

| Destination | Weight | Number/lb | Number released |
|---|---|---|---|
| Knox Bridge | 16,075 | 19.17 | 308,300 |
| Knox Bridge | 26 | 19.17 | 500 |
| Knox Bridge | 17,500 | 17.00 | 297,500 |
| Knox Bridge | 29 | 17.00 | 499 |
| Knox Bridge | 29 | 17.00 | 499 |
| Total Released | 33,659 | | 607,298 |

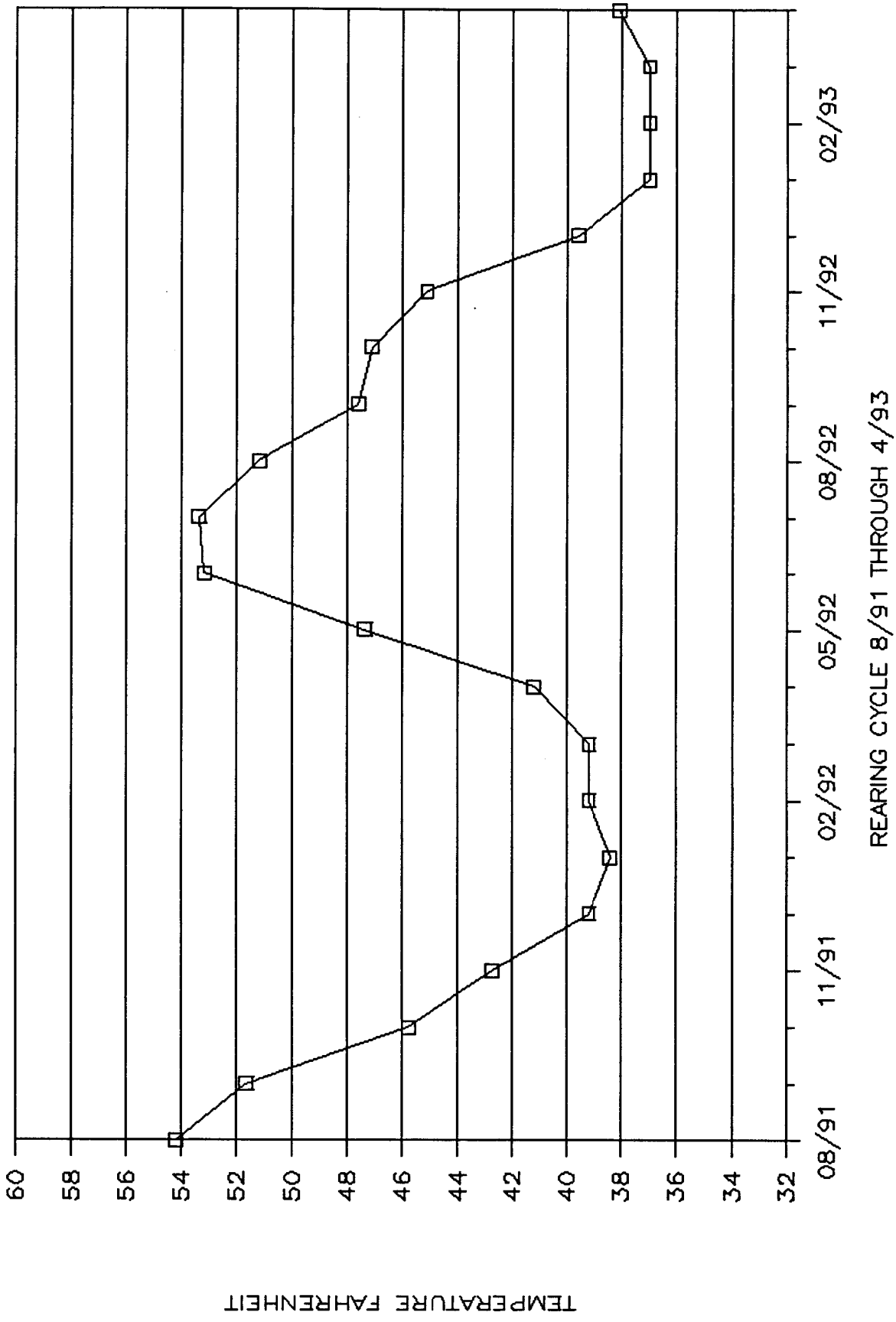
Appendix F. Brood year 1991 chinook survival from green eggs to released smolts.

| Green egg number | Eyed egg number | Percent survival | Ponded | Percent survival | Released smolts | Percent survival |
|---|---|---|---|---|---|---|
| 704,016 | 636,291 | 90.4 | 609,396 | 86.5 | 607,298 | 86.2 |

Appendix G. Temperature range from August 1991 through April 1993.

| Date | Temperature |
|---|---|
| 08/91 | 54.2 |
| 09/91 | 51.7 |
| 10/91 | 45.8 |
| 11/91 | 42.7 |
| 12/91 | 39.2 |
| 01/92 | 38.4 |
| 02/92 | 39.2 |
| 03/92 | 39.2 |
| 04/92 | 41.2 |
| 05/92 | 47.4 |
| 06/92 | 53.2 |
| 07/92 | 53.4 |
| 08/92 | 51.2 |
| 09/92 | 47.6 |
| 10/92 | 47.1 |
| 11/92 | 45.1 |
| 12/92 | 39.6 |
| 01/93 | 37 |
| 02/93 | 37 |
| 03/93 | 37 |
| 04/93 | 38.1 |

Appendix G1. Temperature range graph.



Appendix H. Water analysis.

| Date | pH | Ammonia | Nitrate | Nitrite | Total phosphate | Total KJEL nitrogen | CaCO2 hardness | Percent saturation | Oxygen ppm |
|---|---|---|---|---|---|---|---|---|---|
| 1988 | 6.8 | - | - | - | - | | -<10 | 97-103 | 7-10 |
| 1991 | | <0.05 | <0.1 | <0.1 | <0.05 | <0.10 | | | |

Appendix I. Brood year 1991 production cost table.

| Number of fish | Lbs of feed | Cost of feed | Lbs of fish | Conversion | Total cost | Cost/ 1,000 | Cost/ lb |
|---|---|---|---|---|---|---|---|
| 607,298 | 49,054 | $33,600 | 33,659 | 1.45 | $292,655 | $481.91 | $8.69 |

Appendix J. Brood year 1991 marked fish that were released.

| Date | Number fish marked | Mark | Purpose | Number marked fish released | Site/group release |
|---|---|---|---|---|---|
| 10/1-10/6 | 310,448 | AD/CWT | US-CAN | 306,082 | 607,298 |
| 9/29-9/30 | 132,250 | RV | Supplementation | 132,250 | 607,298 |
| 10/6 | 500 | RV/PIT | Supplementation | 500 | 607,298 |
| 9/28-9/29 | 164,980 | AD/CWT | Supplementation | 159,808 | 607,298 |
| 3/3-3/4/93 | 1,500 | PIT | Time of release | 1,498 | 607,298 |
| Total | 609,678 | | | 600,138 | 607,298 |

Appendix K. Summary of fish autopsies.

LOCATION: McCall
SPECIES: chinook
STRAIN: SFSU
UNIT: pond 1
REASON FOR AUTOPSY: Preliberation
INVESTIGATOR(S): Munson
REMARKS:

ACCESSION NO: 93-44
AUTOPSY DATE: 7/16/93
AGE:
SAMPLE SIZE: 30

| | MEAN | STANDARD DEVIATION | COEFFICIENT OF VARIATION |
|---|---|---|---|
| LENGTH (cm) | 12.751 | 6.862 x $10^{4}$ | 5.381 x $10^{.2}$ |
| WEIGHT (g) | 22.963 | 6.538 | 2.847 x $10'^{1}$ |
| KTL* | 40.655% | 3.638 | 8.948 x $10^{-2}$ |
| CTL** | | | |
| HEMATOCRIT | | | |
| LEUCOCRIT | 10.835 g/100 ml | 8.499 | 7.844 x 10'' |
| SERUM PROTEIN | | | |

*Expressed as KTL times 10 to the fifth power.
**Converted from KTL; expressed at CTL times 10 to the fourth power.

VALUES AS PERCENTS OF TOTAL SAMPLE

| EYES | GILLS | PSEUDO-BRANCHES | THYMUS | MESEN. FAT | SPLEEN | HIND GUT | KIDNEY | LIVER | BILE |
|---|---|---|---|---|---|---|---|---|---|
| N 30 | N 30 | N 30 | 0 30 | 0 | B | 0 30 | N 30 | A | 0 7 |
| B1 | F | S | 1 | 1 | R 30 | 1 | S | B 6 | 1 23 |
| B2 | C | L | 2 | 2 | G | 2 | M | C 24 | 2 |
| El | M | S& | | 3 6 | NO | | G | D | 3 |
| E2 | P | I | x= | 4 24 | E | x= | U | E | - |
| H1 | OT | OT | | | OT | | OT | F | x=0.77 |
| H2 | | | | x=3. | | | | | |
| Ml | | | | | | | | | |
| M2 | | | | | | | | | |
| OT | | | | | | | | | |

SUMMARY OF NORMALS

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 100 % | 100 % | 100% | 100 % | 100% | 100 % | 100% | 100 % | 100 % | 100% |

Appendix K. Continued.

LOCATION: McCall
SPECIES: SU
STRAIN: SF
UNIT: pond 2
REASON FOR AUTOPSY: Preliberation
INVESTIGATOR(S): Munson/Homae
REMARKS:

ACCESSION NO: 93-45
AUTOPSY DATE: 2/16/93
AGE: JUV
SAMPLE SIZE: 30

| | MEAN | STANDARD DEVIATION | COEFFICIENT OF VARIATION |
|---|---|---|---|
| LENGTH (cm) | 131.43 | 0.88 | 0.66 |
| WEIGHT (g) | 25.85 | 5.50 | 0.21 KTL* |
| CTL** | | | |
| HEMATOCRIT | 43.14 | 3.44 | 0.07 LEUCOCRIT |
| SERUM PROTEIN | 9.195 | 8.88 | 0.09 |

*Expressed as KTL times 10 to the fifth power.
**Converted from KTL; expressed at CTL times 10 to the fourth power.

VALUES AS PERCENTS OF TOTAL SAMPLE

| EYES | | GILLS | | PSEUDO-BRANCHES | | THYMUS | | MESEN. FAT | | SPLEEN | | HIND GUT | | KIDNEY | | LIVER | | BILE | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N | 30 | N | 29 | N | 30 | 0 | 30 | 0 | | B | | 0 | 30 | N | 30 | A | | 0 | 5 |
| B1 | | F | | S | | 1 | | 1 | | R | 30 | 1 | | S | | B | 9 | 1 | 25 |
| B2 | | C | | L | | 2 | | 2 | 2 | G | | 2 | | M | | C | 21 | 2 | |
| El | | M | | S& | | | | 3 | 2 | NO | | | | G | | D | | 3 | |
| E2 | | P | | I | | | | 4 | 26 | E | | | | U | | E | | | |
| H1 | | OT | 1 | OT | | x=0.00 | | | | OT | | x=0.00 | | OT | | F | | | |
| H2 | | | | 0 | | | | x=3.80 | | | | | | | | OT | | x=0.83 | |
| Ml | | | | | | | | | | | | | | | | | | | |
| M2 | | | | | | | | | | | | | | | | | | | |
| OT | | | | | | | | | | | | | | | | | | | |

SUMMARY OF NORMALS

| EYES | GILLS | PSEUDO-BRANCHES | THYMUS | MESEN. FAT | SPLEEN | HIND GUT | KIDNEY | LIVER | BILE |
|---|---|---|---|---|---|---|---|---|---|
| 100 % | 97 % | 100% | 100% | 100% | 100% | 100% | 100% | 100 % | 100% |

**Submitted by:**

**Donald E. McPherson**
**Fish Hatchery Superintendent III**

**Approved by:**

**IDAHO DEPARTMENT OF FISH AND GAME**

**Steven M. Huffaker, Chief**
**Bureau of Fisheries**

**Bill Hutchinson**
**Fish Hatcheries Manager**